EXHIBIT 22

[Exhibit 22-480]

IP CORE DEVELOPMENT AND LICENSE AGREEMENT NO. TG11102009

This Agreement is entered into by and between ViaSat, Inc., a Delaware corporation having its headquarters offices located at 6155 El Camino Real, Carlsbad, California 92011-1699, and having a branch office located at 4830 East 49th Street, Cuyahoga Heights, Ohio   44125 (hereinafter referred to as "VIASAT") and Acacia Communications, Inc. a Delaware corporation having its principal place of business at 1000 Winter Street, Suite 4500, Waltham, Massachusetts 02451 (hereinafter referred to as "ACACIA"), as of the Effective Date defined in Clause 1.

WHEREAS VIASAT has extensive background and expertise in communications systems, and intellectual property core ("IP core") design and verification; including the successful incorporation of communications technology on a variety of platforms, such as Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) programmable Digital Signal Processors (DSPs), and software (C/C++, Matlab, etc.).

WHEREAS ACACIA would like to commission VIASAT to undertake the development of an ASIC IP core for Digital Signal Processing (the "DSP Core") and an IP core for Soft Decision Forward Error Correction Decoder and Encoder (the "SDFEC Core") targeting an OTU4 (100Gb) optical transport application;

NOW, THEREFORE, in consideration of the mutual covenants and Agreements contained herein, VIASAT AND ACACIA agree as follows:

1.   Definitions

As used in this Agreement the following defined terms shall have the meanings set forth below:

(a)   "Affiliate" shall mean any company controlling, controlled by or under common control with a specified party, wherein "control" means the power to determine the management policies of such company by either ownership of a majority of the voting rights of its issued capital, or having the right to appoint a majority of the members of its board of directors, or by Agreement or otherwise.

(b)   "Background Information" means all Intellectual Property Rights, and other design data and information either (a) owned or licensed by VIASAT prior to the Effective Date of this Agreement, or (b) developed or licensed by VIASAT separate and apart from this Agreement. Background Information shall also include all technical data, manuals and other documentation and data related to any of the foregoing. For the sake of clarity, and without limiting the foregoing, the SDFEC Core shall be deemed Background Information.

(c)   "Copyrights" means copyrights and copyrightable works, in any form or medium now in existence or hereinafter created and all derivative works thereto, and all registrations, applications and renewals for any of the foregoing.

(d)   "Deliverables" shall mean the deliverables provided by VIASAT to ACACIA pursuant to the Development Services. For the sake of clarity, the term Deliverable shall include all Foreground Information and Licensed Materials provided by VIASAT to ACACIA hereunder.
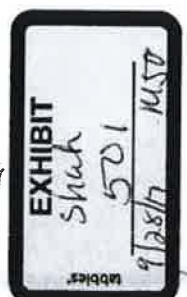
(e)   "Development Services" shall have the meaning set forth in Clause 2(a).

[Exhibit 22-481]

(f)   "Effective Date" means the commencement date of this Agreement, and which shall be established as the last date signed by the Parties hereto on the last page of this Agreement.

(g)   "End User" means an end user customer who purchases or agrees to purchase the Licensed Products.

(h)   "Intellectual Property Rights" means any and all inventions (whether or not patentable and whether or not reduced to practice); patents and patent applications and continuations thereof; works of authorship and other copyrightable works; Copyrights; mask work rights; trade secrets (including, without limitation, data, ideas, formulae, compositions, manufacturing and production processes and techniques, know-how, research and development information, drawings, specifications, designs, plans, proposals, technical data, software (source and object code), financial, business and marketing plans, sales and promotional literature, customer and supplier lists and related information); information technologies (including, without limitation, software programs (both source and object code), data and related documentation); all other intellectual property rights throughout the world; and all copies and tangible embodiments of the foregoing in whatever form or medium.

(i)   "Interim Agreement" means that certain Preliminary ASIC IP Core Development Agreement between the parties effective as of September 4, 2009.

(j)   "Foreground Information" means all Intellectual Property Rights, design data and information (a) directly related to the Digital Signal Processing (DSP) Blocks for use in 100Gb Optical Systems described in Exhibit C hereof, entitled "Mutually Agreed Upon Specification for 100 Gbps Coherent DWDM Demodulator" to be delivered as part of Deliverable 2V/3A in Exhibit A, the Statement of Work (SOW), that are first developed or first created by VIASAT or its personnel during the course of performing services for ACACIA under this Agreement, or (b) that are first developed or first created by VIASAT or its personnel in the performance of its services relating to Digital Signal Processing under this Agreement, and including all changes, additions, revisions, replacements, manuals and documentation thereto which VIASAT may provide under this Agreement. For the sake of clarity, and without limiting the foregoing, the DSP Core and all Deliverables relating thereto shall be deemed Foreground Information.

(k)   "Licensed Materials" means the SDFEC Core provided to ACACIA as part of the Development Services hereunder, in whatever form provided (whether as floppy or hard disks, cartridges, magnetic tapes, semiconductor chips or otherwise) or however designated (whether as firmware, microcode or otherwise) and including all changes, additions, revisions, replacements, manuals and documentation thereto which VIASAT may provide under this Agreement. For the avoidance of doubt, source code for Licensed Materials shall not be delivered to ACACIA under this Agreement and shall not be a Licensed Material.

(l)   "Licensed Products" means any integrated circuits (ASIC and/or FPGA) designed, manufactured, marketed or sold by or on behalf of ACACIA that incorporate all or any part of the Licensed Materials (regardless of whether or not the Licensed Materials are enabled or disabled in such Licensed Product).

(m)   "Royalty Bearing Products" means Licensed Products that incorporate all or part of the Licensed Materials regardless of whether or not the Licensed Materials are in an enabled form or disabled form.

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[Exhibit 22-482]

(n)   "Permitted Use" means use by ACACIA of the Licensed Materials in accordance with Clause 4 below.

(o)   "Recurring Royalty Fee" shall mean the per unit recurring royalty fee(s) payable to VIASAT by ACACIA under this Agreement as described in Clause 4 below.

(p)   "Development Specifications" means the specifications made by ACACIA to VIASAT for the Foreground Information attached hereto and made a part of this Agreement as Exhibit C, which are mutually agreed to be considered draft specifications at the time of executing this Agreement, but which shall be converted to mutually agreeable final specifications in accordance with the process and timeline set forth in the SOW in Exhibit A.

(q)   "Licensed Materials Specifications" means the specifications for the Licensed Materials set forth in Exhibit B.

(r)   "Specifications" means the Development Specifications and the Licensed Materials Specifications, collectively.

2.   **IP Core Development Phase Scope, Price and Acceptance**

(a)   ViaSat will provide the necessary personnel, materials, services and facilities to perform the IP core development phase work (the "Development Services") specified in Exhibit A, entitled "Statement of Work for IP Core Development" which is attached hereto and made a part of this Agreement as Exhibit A. VIASAT shall perform the Development Services and deliver all Deliverables within the timeline set forth in Exhibit A.

(b)   ViaSat will perform such Development Services for the NRE firm fixed price of Three Million Two Hundred Thousand Dollars ($3,200,000) (the "NRE Fee"), subject to such additional amounts for products or services set forth in Exhibit A regarding out-of-scope design iterations requested by ACACIA, which will be handled on a time and materials basis at rates set forth in Exhibit D or, if not set forth therein, as mutually agreed between the parties. Payments made by ACACIA to VIASAT pursuant to the Interim Agreement shall be credited toward the NRE Fee.

(c)   VIASAT may invoice ACACIA for the NRE Fee upon completion of each payment milestone set forth in Exhibit A (hereafter referred to as a "Payment Milestone") and ACACIA's acceptance thereof in accordance with Clause 2(d). Payment associated with each successfully achievedPayment Milestone shall be payable within thirty (30) days after ACACIA's receipt of ViaSat's invoice. Any undisputed amounts not paid when due shall be subject to a late payment fee of one and one-half percent (1.5%) per month or the maximum amount permitted by law, whichever is less.

(d)   Acceptance of the Development Services work shall occur after completion of acceptance tests in accordance with the SOW in Exhibit A. Acacia shall evaluate, and if applicable, conduct preliminary tests to verify conformance of each Deliverable to the applicable Specifications, and notify VIASAT of its acceptance within the applicable review time cycle(s) set forth in the SOW. If, within such applicable review time cycle ACACIA, in its good faith judgment, reasonably believes that any portion of the Deliverables does not conform to the applicable Specifications in any material respect, ACACIA shall within such applicable review time cycle deliver written notice to VIASAT of such non-conformity to the applicable

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IP CORE DEVELOPMENT AND LICENSE AGREEMENT NO. TG11102009
Page 3 of 13
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[Exhibit 22-483]

Specifications ("Statement of Errors"), listing all discovered non-conformities. VIASAT shall use commercially reasonable efforts, at its own expense (except that if the non-conformity is due to any action or inaction on the part of ACACIA, in which case ACACIA shall bear the cost of correction) to correct such non-conformities within ten (10) business days but in no event longer than thirty (30) calendar days of its receipt of such a Statement of Errors. Upon receipt of the corrected Deliverable, ACACIA shall retest the Deliverable as set forth above. If ACACIA determines that the Deliverable still does not comply with the applicable Specifications in any material respect, ACACIA shall have the option of (a) rejecting the Deliverable as set forth above and asking VIASAT to repeat the corrective action described above, (b) agreeing upon a fix strategy with VIASAT (c) paying the associated Deliverable's Payment Milestone, if any, and proceeding to the next delivery milestone set forth in Exhibit A, or (d) terminating this Agreement upon written notice to VIASAT. In the event ACACIA has not (i) conducted any such acceptance tests or (ii) notified VIASAT as to any non-conformity within the applicable review time cycle(s) set forth in the SOW, such Deliverables shall be deemed accepted, unless the parties mutually agree in writing that circumstances warrant extending any such acceptance testing, which such agreement shall not be unreasonably withheld; in which case ViaSat and ACACIA will jointly develop a mutually agreeable extended acceptance test plan and a reasonable time period to be allowed for ACACIA to perform such extended acceptance test plan, taking into consideration the complexity of the extended acceptance testing to be performed.

(e)   In the event that ACACIA terminates this Agreement pursuant to Clause 2(d)(d), VIASAT shall immediately cease performing additional Development Services and VIASAT shall be entitled to retain all amounts received to date, and a prorated amount for work performed toward the next to occur Payment Milestone. Notwithstanding anything to the contrary herein, in the event that ACACIA terminates this Agreement pursuant to Clause 2(d)(d) hereof all licenses hereunder, including without limitation licenses to the Licenses Materials, shall be terminated and revoked.

3.   **Foreground Information**

(a)   ACACIA shall own all right, title and interest in and to all Foreground Information, including all Intellectual Property Rights therein and thereto. VIASAT will promptly provide and fully disclose all Foreground Information to ACACIA. All Foreground Information is works made for hire to the extent allowed by law and, in addition, VIASAT, at ACACIA's sole expense, hereby makes and agrees to make all assignments necessary to accomplish the foregoing ownership. VIASAT shall assist ACACIA, at ACACIA's sole expense, to further evidence, record and perfect such assignments, and to perfect, obtain, maintain, enforce, and defend any rights assigned. If VIASAT is unavailable, unable or unwilling to so assist ACACIA, VIASAT hereby irrevocably designates and appoints ACACIA, solely in connection with the exercise of its ownership rights in the Foreground Information, as it agent and attorney in fact to act for and in VIASAT's behalf to execute and file any document and to do all other lawfully permitted acts to further the foregoing with the same legal force and effect as if executed by VIASAT.

(b)   If any part of the Foreground Information is based on, incorporates or is an improvement or derivative of, or cannot be reasonably and fully made, used, reproduced, modified, distributed or otherwise exploited, without using any Background Information, then VIASAT hereby grants and agrees to grant to ACACIA a limited, nonexclusive, perpetual, irrevocable, worldwide, royalty-free, sublicensable right and license to make, have made, use and have used, sell, import, export, reproduce, modify and make derivative works of such Background Information for the sole and exclusive purpose of design, simulation, implementation, manufacture

[Exhibit 22-484]

and sale of Licensed Products (including any modifications, improvements and derivatives to Licensed Products) or otherwise in connection with ACACIA's exploitation of the Foreground Information. VIASAT agrees not to use or disclose any Background Information under this Agreement for which it is not fully authorized to grant the foregoing license.

4.   License; Recurring License Fee; Licensed Material Delivery

(a)   VIASAT hereby grants to ACACIA for the Term of this Agreement a limited, worldwide, nonexclusive, non-transferable right and license (i) to make, have made, use, reproduce and make derivative works of the Licensed Materials, solely for the design, simulation, implementation and manufacture of Licensed Products, and (ii) to reproduce, make, have made, use, sell, offer to sell, import, export or otherwise distribute Licensed Products incorporating the Licensed Materials on a worldwide basis. Use of the Licensed Materials for any product other than the Licensed Product is strictly prohibited unless ACACIA has entered into a separate written Agreement with VIASAT for such use.

(b)   The foregoing license is granted to ACACIA under this Agreement subject to: (i) ACACIA's full payment of all Development Services NRE amounts owed to VIASAT under Clause 2 above; and (ii) payment of a per unit Recurring Royalty Fee in accordance with the following table per each Royalty Bearing Product sold by or on behalf of ACACIA:

Recurring Royalty Fee	Cumulative Instantiation Quantity	Recurring Royalty Fee ($)
	0 to 2,500	$750/instantiation
	2,501-10,000	$500/instantiation
	>10,000	$150/instantiation

Notwithstanding anything to the contrary contained in this Agreement, no Recurring Royalty Fee shall be due for Licensed Products that are: (i) used or distributed solely for internal use by ACACIA (except any subsequent sale of the same would bear such Recurring Royalty Fee), (ii) used or distributed solely for demonstration, marketing or training purposes (except any subsequent sale of the same would bear such Recurring Royalty Fee), provided such use and distribution shall be limited to an aggregate of fifty (50) units, (iii) distributed to an End User as a replacement for a defective Licensed Product or to fix an error in a Licensed Product (but only to the extent a Recurring Royalty Fee was paid on the original Licensed Product so replaced or corrected), (iv) returned by an End User (except only to the extent a complete refund of the purchase price is made by ACACIA to such End User), or (v) used solely for ACACIA's manufacturing or testing purposes.

(c)   Restricted Activities. As additional protection for Acacia's Confidential Information, VIASAT agrees that during the period over which it is (or is supposed to be) providing Development Services under this Agreement (i) and for six (6) months thereafter (the "Restricted Period"), ViaSat will not (i) engage in activities related to the Foreground Information which are directly competitive with the 100Gb transponder module business or demonstrably anticipated 100Gb transponder business of ACACIA or (ii) provide services related to the "Foreground Information" to (a) any third parties in the 100Gb optical transponder module market who are engaged in activities directly competitive with the 100Gb transponder business or demonstrably anticipated 100Gb transponder business of ACACIA or (b) any third party that is or

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[Exhibit 22-485]

was previously a customer or business partner of ACACIA if such services are in support of the 100Gb optical transponder module market.

5.   Taxes

All international, national, regional or local taxes, duties or similar liabilities, however designated, except for income taxes imposed by the U.S. Government or its political subdivisions, which may be levied upon VIASAT in connection with this Agreement (excluding taxes based on VIASAT's income) shall be for the account of ACACIA and paid directly by ACACIA or, if required to be paid by VIASAT, shall be immediately reimbursed by ACACIA to VIASAT upon evidence of payment.

6.   Accounting and Payment for Recurring Royalties

(a)   During the Term ACACIA shall keep accurate, separate and complete records in sufficient detail to enable the payments due hereunder to be determined (and to permit and allow ViaSat to confirm the same pursuant to Clause 6(c)).

(b)   Within thirty (30) days after the end of each calendar quarter during the Term of this Agreement, beginning with the first calendar quarter after ACACIA completes development of its first prototype of a Licensed Product, ACACIA shall transmit a written report to VIASAT with respect to accounting for all Recurring Royalty Fee payments due hereunder. Such report shall indicate (i) the quantity of Royalty Bearing Products shipped during the reporting quarter, (ii) the per unit Recurring Royalty Fee attributable to such Royalty Bearing Products as set forth in Clause 4 above, (iii) the cumulative Recurring Royalty Fees owed to VIASAT for such period and (iv) such other reasonable information requested by VIASAT from time to time. If no such sales have been made during any reporting period, ACACIA shall so report. Contemporaneously with submitting each such quarterly report, ACACIA shall submit its payment for all reported Recurring Royalty Fees in cash by means of electronic wire transfer using the following instructions:

Electronic Wire Transfer Instructions

Bank:	Union Bank of California
Address:	530 "B" Street
	San Diego, CA 92101-4407 USA
Routing Transit #:	122000496
Acct Name:	ViaSat, Inc. General Checking Account
Acct #:	4000142625
Swift ID:	BOFC US 33 MPK
	(For international wire transfers)

Any Recurring Royalty Fees which are not paid by ACACIA within thirty (30) days after the close of the calendar quarter in which ACACIA received the revenue attributable to such Royalty Bearing Product shall be subject to a late payment fee of one and one-half percent (1.5%) per month or the maximum percent permitted by law, whichever is less.

IP CORE DEVELOPMENT AND LICENSE AGREEMENT NO. TG11102009
Page 6 of 13

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[Exhibit 22-486]

(c)   Upon seven days written notice from the VIASAT, ACACIA shall permit an independent certified public accountant, reasonably acceptable to ACACIA, to have access, no more than once each calendar year during regular business hours, to such records or documents of ACACIA as may be necessary to verify the accuracy of the reports and payments made under this Agreement, including but not limited to, invoices, contracts and purchase orders, and to make copies thereof. The cost of such audit shall be at VIASAT's sole cost and expense, except if the review uncovers an underreporting in the reported license fees or other amounts due of more than five percent (5%), in which case ACACIA shall promptly pay to VIASAT (i) such underreported or unpaid amount plus (ii) the cost of said audit.

7.   **Term; Termination**

(a)   The term of this Agreement shall commence as of the Effective Date and shall continue until terminated as set forth in this Clause 7 ("Term").

(b)   ACACIA may terminate this Agreement for any reason at any time upon thirty (30) days prior written notice to VIASAT. In the event that ACACIA terminates this Agreement pursuant to this Clause 7(b), VIASAT shall immediately cease performing additional Development Services and VIASAT shall be entitled to retain all amounts received to date, plus ACACIA shall promptly pay to VIASAT (i) a prorated amount for work performed toward the next to occur Payment Milestone plus (ii) any non-cancellable expenses incurred by VIASAT prior to receipt of ACACIA's notice of termination plus (iii) any other amounts due and payable.

(c)   Either party may terminate this Agreement based on material breach of the Agreement by the other party, provided that, for any breach capable of cure, the party alleged to be in material breach receives written notice stating the cause and is provided thirty (30) days to cure such material breach. In the event of termination pursuant to this Clause 7(c), any payment obligations accruing prior to such termination will remain due and owing and VIASAT shall be entitled to seek injunctive relief allowing VIASAT to recover from ACACIA any Licensed Materials already delivered to ACACIA, in addition to any other remedies available, it being acknowledged that legal remedies may be inadequate.

(d)   Upon termination of this Agreement, (i) except as expressly set forth below, the licenses, rights and covenants granted hereunder and the obligations imposed hereunder will cease; (ii) ACACIA will destroy the Licensed Materials, including all copies and all relevant documentation and within ten days of termination provide written certification of such destruction to VIASAT, except that, if this Agreement is terminated for any reason other than ACACIA's material breach thereof, ACACIA may sell any Licensed Products already in inventory as of the effective date of Termination subject to payment of the applicable Recurring Royalty Fee for any Royalty Bearing Products sold. The provisions of Clauses 1, 3, 8, 9, 11, 12, 13, 14, 18, 19 and this Clause 7(d) will survive the termination of this Agreement.

8.   **Background Information Title; Intellectual Property Rights: Copying**

(a)   ACACIA acknowledges that all Intellectual Property Rights in the Background Information and the Licensed Materials are and will remain the sole property of VIASAT, including all modifications, improvements, and derivative works relating to the Background Information and the Licensed Materials, including but not limited to all modifications, improvements, and derivative works requested or suggested by ACACIA.

[Exhibit 22-487]

(b)   To protect such Intellectual Property Rights, ACACIA agrees that it will use any Background Information and/or Licensed Materials it receives from VIASAT under this Agreement only as authorized herein and for the term specified herein and agrees that it will not decompile, reverse engineer, disassemble, or otherwise reduce any Background Information and/or Licensed Materials it receives from VIASAT under this Agreement to a human-perceivable form except to the extent any of the foregoing restrictions are prohibited by law. ACACIA may not modify or prepare derivative works of any Background Information and/or Licensed Materials it receives from VIASAT under this Agreement in whole or in part, except with respect to the purposes of the Licensed Products. Nothing contained in this Agreement will be construed as conferring by implication, estoppel or otherwise upon either party any license or other right except the licenses and rights expressly granted in this Agreement to a party hereto. ACACIA acknowledges that any Background Information and/or Licensed Materials it receives from VIASAT under this Agreement represents valuable property of VIASAT, and may be protected by copyright law.

(c)   This Agreement allows ACACIA to copy any Background Information and/or Licensed Materials it receives from VIASAT under this Agreement only to the extent expressly provided herein, and for archival and back-up purposes, provided always that ACACIA will at all times and in each instance, reproduce all copyright notices and proprietary legends on each copy in the same manner as such notices and legends appeared on the original. No other copies may be made without VIASAT's prior written consent. ACACIA may not provide design data or information including, but not limited to, schematics, hardware description language source code, or netlist files, to a third party without prior written approval from VIASAT.

9.   Confidentiality

Each Party shall maintain in strict confidence, and will use and disclose only as authorized by the disclosing party, in accordance with the provisions of Non-Disclosure Agreement #NDATG06102009 executed between them on June 10, 2009 (the "NDA"), all information that it receives from the other Party in connection with this Agreement (including pursuant to a SOW), including, but not limited to, all information concerning trade secrets, engineering, material, supplies, hardware, equipment, software or other technical information of the other Party's products or financial, accounting or marketing information, business plans, analyses, forecasts, predictions or projections, and customer information relating to the other Party's business, and personnel information relating to the other Party's employees (hereinafter referred to as "Confidential Information"). All Foreground Information shall be deemed ACACIA's Confidential Information for purposes of the NDA. The terms of this Clause 9 shall survive the termination of this Agreement.

10.   Right to Transfer to the U.S. Government

For any Licensed Materials subsequently ordered from ACACIA under a U.S. Government prime contract or subcontract (of any tier), ACACIA shall have the right, upon written prior notice to VIASAT, and subject to the limits of the license rights granted under this Agreement, to transfer said Licensed Materials to the U.S. Government provided that the Government agrees to accept said transfers subject to Restricted Rights as such rights are defined and limited by the Rights in Technical Data and Computer Software clause in DFARS 252.227-7013.

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[Exhibit 22-488]

11.   Indemnity

VIASAT will defend, protect, indemnify and hold ACACIA and its officers, directors, and employees and its affiliates and their respective officers, directors, and employees, harmless from and against any and all third party demands, claims, liabilities, losses, costs and expenses (including reasonable attorneys' fees), losses or damages to persons or property, injuries or death of persons (including the amounts of judgments, settlement amounts, penalties, interest, court costs and legal fees, including on appeal or review) arising out of or relating to any negligent act or omission, or default by VIASAT or its personnel under this Agreement.

12.   Warranties, Limited Remedy and Disclaimer.

(a)   VIASAT represents warrants to ACACIA that: (i) VIASAT has and shall have all rights necessary to grant the rights and licenses granted hereunder; (ii) VIASAT has the required skills, expertise and experience to perform this Agreement; and (iii) VIASAT's performance of its obligations under this Agreement shall at all times comply with any and all applicable material laws and regulations.

(b)   VIASAT represents and warrants that, for a period of one (1) year after ACACIA's commencement of production of Licensed Products (the "Warranty Period"), the Licensed Materials and Foreground Information will conform to the Specifications in all material respects and be free from material defects in design, manufacture, engineering, materials and workmanship. In the event the Licensed Materials and Foreground Information fail to meet the Specifications in all material respects, VIASAT shall repair or replace the non-conforming Licensed Materials or Foreground Information. VIASAT's sole liability and the ACACIA's exclusive remedy with respect of breach of the foregoing limited representation will be limited to error correction or replacement.

(c)   EXCEPT AS SPECIFICALLY STATED IN THIS CLAUSE 12, THE LICENSED MATERIALS LICENSED HEREUNDER ARE PROVIDED WITHOUT ANY OTHER WARRANTY OF ANY KIND, EITHER EXPRESSED, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION, ANY WARRANTY WITH RESPECT TO NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

13.   Limitations of Liability

EXCEPT FOR BREACHES OF CLAUSE 9 (CONFIDENTIALITY) OR THE NDA, OR AMOUNTS PAYABLE TO THIRD PARTIES PURSUANT TO CLAUSE 11 (INDEMNITY), (A) IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY FOR LOSS OF PROFITS OR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM OR ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT, WHETHER OR NOT SUCH PARTY HAD BEEN ADVISED, KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF DATA, LOSS OF USE OR LOSS OF REVENUE, AND (B) EXCEPT FOR VIASAT'S OBLIGATION TO CORRECT DEFECTIVE LICENSED MATERIALS AND FOREGROUND INFORMATION PURSUANT TO CLAUSE 12, THE TOTAL CUMULATIVE LIABILITY OF EITHER PARTY UNDER THIS AGREEMENT, WHETHER ARISING

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[Exhibit 22-489]

OUT OF BREACH OF CONTRACT (INCLUDING BUT NOT LIMITED TO BREACH OF WARRANTY) OR TORT (INCLUDING BUT NOT LIMITED TO NEGLIGENCE AND STRICT LIABILITY), IN NO EVENT SHALL EXCEED THE AGGREGATE AMOUNT PAID BY ACACIA TO VIASAT PURSUANT TO THIS AGREEMENT.

14.   Import/Export

ACACIA agrees to comply with all applicable U.S. import/export laws and regulations regarding the Licensed Materials including, but not limited to, the Arms Export Control Act (22 USC 2751 et seq.), the International Traffic in Arms Regulations (22 CFR Part 120 et seq.), and the Export Administration Act (50 USC 2401 et seq.). Without limiting the foregoing, ACACIA agrees that it will not transfer any export controlled-item, data or services to any third party without an export license, Agreement, or applicable exemption or exception.

15.   Notices

All formal contractual notices under this Agreement shall be sent via email or facsimile and confirmed with a signed copy sent by regular mail as follows:

ViaSat, Inc.
Russell Fuerst, Vice President
4830 East 49th Street
Cuyahoga Heights, Ohio 44125
Phone: (216) 706-7619
Fax: (216) 441-8860
Russell.fuerst@viasat.com

Acacia Communications, Inc.
Bhupen Shah
1000 Winter Street, Suite 4500
Waltham, Massachusetts 02451
Phone: (617) 510-1411
Fax:
bhupen.shah@acacia-inc.com

With a copy sent to:

ViaSat, Inc.
Ted Gammell, Director, Contracts
20511 Seneca Meadows Parkway, Suite 200
Germantown, Maryland 20876

(240) 686-4490
(240) 686-4810
ted.gammell@viasat.com

Acacia Communications, Inc.
Marc F. Dupré, Esq.
Gunderson Dettmer LLP
610 Lincoln Street
Waltham, MA 02451
781-890-8800
781-622-1622
mdupre@gunder.com

Either party may change the above points of contact or addresses by seven (7) days prior written notice to the other party.

16.   Entire Agreement

This Agreement and the NDA, and any referenced attachments thereto, contains the entire understanding between the parties, superseding any and all prior and contemporaneous communications, agreements and understandings between the parties with respect to the subject matter hereof. For the sake of clarity, and without limiting the foregoing, this Agreement shall supersede and replace the Interim Agreement. This Agreement may be executed in one or more counterparts, each of which is an original, but together constituting one and the same instrument.

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[Exhibit 22-490]

Execution of a facsimile copy shall have the same force and effect as execution of an original, and a facsimile signature shall be deemed an original and valid signature.

17.   Assignment and Parties of Interest

Except as may be expressly authorized elsewhere herein, neither this Agreement nor any rights granted hereunder may be sold, assigned or transferred by a Party in any manner without the prior written consent of the other Party, which consent will not be unreasonably withheld, conditioned or delayed. Notwithstanding the foregoing, each Party will, without consent of the other Party, have the right to assign all or any part of its rights and obligations under this Agreement to any successor to all or substantially all of its business that concerns this Agreement (whether in connection with a merger, consolidation, or sale of all or substantially all of the assets or stock of the assigning Party). This Agreement will inure to the benefit of, and be binding upon, VIASAT and ACACIA, their successors and permitted assigns. This Agreement is enforceable only by VIASAT and ACACIA. The terms of this Agreement are not a contract or assurance regarding compensation, continued employment, or benefit of any kind to any of VIASAT's personnel assigned to ACACIA's work, or any beneficiary of any such personnel, and no such personnel, or any beneficiary thereof, will be a third-party beneficiary under or pursuant to the terms of this Agreement. The parties shall be independent contractors in their performance under this Agreement, and nothing contained herein will constitute either party as the employer, employee, agent or representative of the other party, or both parties as joint venturers or partners for any purpose.

18.   Severability

If any provision of this Agreement or any portion or provision hereof applicable to any particular situation or circumstance is held invalid, the remainder of this Agreement or the remainder of such provision (as the case may be), and the application thereof to other situations or circumstances, will not be affected thereby.

19.   Choice of Law

This Agreement shall be governed by the laws of the State of Delaware, without regard to its principles of conflict of laws. The United Nations International Sale of Goods Convention shall not apply to this Agreement.

20.   Force Majeure

Neither party shall not be liable for any loss, damage, detention, or delay resulting from failure to perform under this Agreement due to causes beyond such party's reasonable control, including, but not limited to, acts of God or of the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, labor disputes, embargoes, unusually severe weather, insurrection or riot. In the event of delay resulting from any such causes, an equitable adjustment shall be made in the prices set forth in this Agreement (if warranted by the delay) and the performance dates hereof shall be extended for a reasonable length of time (if warranted by the delay) , but no event for less than the period of delay.

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[Exhibit 22-491]

21.   Indemnity for Intellectual Property Infringement

(a)   VIASAT agrees defend and hold harmless ACACIA from and against any claims, liabilities or actions and to pay all costs, losses, damages, settlement amounts and attorneys' fees incurred in connection with any claim by a third party against ACACIA to the extent that such claim alleges that the design or the construction of a Deliverable, as furnished by VIASAT under this Agreement, infringes the U.S. Intellectual Property Rights of such third party, provided that ACACIA promptly notifies VIASAT, in writing, of such claims (except that any delay or failure in notification shall not relieve VIASAT of its obligations except to the extent it has been prejudiced thereby), and provided ACACIA gives VIASAT the sole right to defend and settle such claim at VIASAT's expense with counsel of VIASAT's choice (provided that ACACIA may participate in the defense and settlement of any such claim with counsel of its own choosing at its own expense). ACACIA shall cooperate with VIASAT in the defense or settlement of the claim.

(b)   If the manufacture, use or sale of a Deliverable is enjoined, VIASAT shall, at VIASAT's expense, to do one of the following: (a) obtain for ACACIA the right to use the allegedly infringing Deliverable, (b) modify the allegedly infringing Deliverable so that it becomes non-infringing or (c) replace the allegedly infringing Deliverable with a non-infringing Deliverable that is substantially in compliance with the Specifications for the alleged infringing Deliverable in all material respects. If VIASAT believes a Deliverable is likely to be the subject of a claim, suit, proceeding or injunction, VIASAT shall also have the right, at VIASAT's option, to do any of the above. If VIASAT elects to replace an allegedly infringing Deliverable with a non-infringing item, ACACIA shall return the allegedly infringing Deliverable to VIASAT as soon as practicable.

(c)   Under no circumstances shall VIASAT have any liability for infringement to the extent such infringement arises from or occurs as a result of (i) the use of the Deliverables in combination and/or configuration with other items not furnished by VIASAT, (ii) incorporation of a specific design or modification at the request of ACACIA, (iii) Intellectual Property Rights owned by ACACIA or (iv) the failure by ACACIA to implement changes, replacements or new releases recommended by VIASAT, where the infringement would have been avoided by such changes, replacements or new releases and such changes would not have substantially impaired the functionality of the Deliverable. ACACIA agrees defend and hold harmless VIASAT from and against any claims, liabilities or actions and to pay all costs, losses, damages, settlement amounts and attorneys' fees incurred in connection with any claim by a third party against VIASAT to the extent that such claim arises out of any of the foregoing, provided that VIASAT promptly notifies ACACIA, in writing, of such claims (except that any delay or failure in notification shall not relieve ACACIA of its obligations except to the extent it has been prejudiced thereby), and provided VIASAT gives ACACIA the sole right to defend and settle such claim at ACACIA's expense with counsel of ACACIA's choice (provided that VIASAT may participate in the defense and settlement of any such claim with counsel of its own choosing at its own expense). VIASAT shall cooperate with ACACIA in the defense or settlement of the claim.

(d)   This Clause 21 specifies each party's entire liability with respect to infringement of third party Intellectual Property Rights. VIASAT makes no warranty of non-infringement, express or implied. Notwithstanding Clause 13, ViaSat's total liability for the cost of any award of damages and costs, or settlement arising under this Clause 21 shall not exceed an amount equal to two (2) times the aggregate amount paid by Acacia to ViaSat pursuant to this Agreement. The existence of one or more claims or lawsuits shall not exceed this amount.

IP CORE DEVELOPMENT AND LICENSE AGREEMENT NO. TG11102009
Page 12 of 13

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[Exhibit 22-492]

22.   Modification and Waiver

This Agreement may only be modified or amended in a writing signed by an authorized representative of each party. A waiver or failure to exercise any right provided for in this Agreement in any respect shall not be deemed a waiver of any further or future rights hereunder. Except as specifically provided otherwise, each right and remedy in this Agreement is in addition to any other right or remedy, at law or in equity, and the exercise of one right or remedy will not be deemed a waiver of any other right or remedy.

IN WITNESS WHEREOF, the parties have caused this Agreement to be duly executed in duplicate originals by their duly authorized representatives on the day and year first above written.

VIASAT, INC.	ACACIA COMMUNICATIONS, INC.
Signature (*):	Signature (*):
Name: Ted M. Gammell	Name: Christian Rasmussen
Title: Director, Contracts	Title: President
Date: November 13, 2009	Date: November 20, 2009

(*) - Delivery of an executed counterpart of a signature page to this Agreement by facsimile or email shall be effective as delivery of a manually executed counterpart of this Agreement.

TMG
11/13/09

CR
11/20/09

[Exhibit 22-493]

<u>**EXHIBIT A - STATEMENT OF WORK**</u>

This Statement of Work (the "SOW") is incorporated by reference under the ASIC Core Development and Licensing Agreement No. TG11102009 dated as of November 20, 2009 by and between Acacia and ViaSat (the "Agreement").

1   PRIMARY CONTACTS

In connection with the Services to be performed under this SOW, the primary contacts for the Parties will be as follows:

Party	Contact	Contact Information
Acacia	Bhupen Shah	Acacia Communications, Inc. 3 Clock Tower Place Suite 210 Maynard, MA 01754
ViaSat	Russell Fuerst	ViaSat Inc. 4830 East 49th Street Cuyahoga Heights, OH 44125 216-706-7800 russell.fuerst@viasat.com

2   SUMMARY OF THE DEVELOPMENT

The SOW is provided by ViaSat, Inc. ("ViaSat") and is based upon, Exhibit C, the draft Mutually Agreed Upon Specification for 100 Gbps Coherent DWDM Demodulator.   Acacia Communications ("Acacia') would like ViaSat to design and develop intellectual property (IP) cores for integration into a DIGITAL ASIC for a coherent demodulator according to Acacia design specifications. The ASIC is targeted towards the Fujitsu 40 nm process technology chosen by Acacia.

3   DELIVERABLES AND FORMATS

(a) ViaSat will develop and deliver the demodulator IP cores according to Exhibit C, draft Mutually Agreed Upon Specification for 100 Gbps Coherent DWDM Demodulator.

Table 1 shows the expectations and responsibilities along with the format to be delivered for each *deliverable.*

(b) ViaSat will deliver the soft decision FEC in an ASIC netlist format along with encrypted RTL for simulation purposes.

Table 2 shows the deliverables along with the format to be delivered for the *soft decision FEC (SDFEC) decoder and encoder cores.*

Design documentation, Interface Specifications and Verification Test Plan documents will be delivered to Acacia by ViaSat, as indicated below, as part of the complete design effort. Review meetings will be held between ViaSat and Acacia to discuss inputs from Acacia on the delivered documents (these reviews will be held by teleconference and/or Web-Conferencing). Upon mutual acceptance, ViaSat shall implement the suggestions/feedback provided by Acacia.

Items noted in the first column indicate responsibility "A" = Acacia and "V" = ViaSat

Table 1. Deliverables and Responsibilities for DSP IP cores

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
Requirements document ViaSat will deliver Architecture specification of the DSP block. This document should contain functional details, architecture information. Acacia will deliver Performance Requirements and implementation considerations for ViaSat if any, such as desired FPGA RAM blocks, ASIC gate count etc. Details from the architecture specification to be defined clearly by ViaSat. Acacia to review and provide feedback. Final review and acceptance of requirements					

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 2 of 11

[Exhibit 22-495]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
document provided by Acacia. ViaSat will provide simulation and design support for the demodulator design through integration of Acacia supplied optical communications channel models including fiber impairments, and transmitter and receiver impairments.					
1AV	Architecture Specification	MS Word/ Adobe	MS Word	Architecture Specification	Interim Monthly Payment Nov-20-09 $150,000 Interim Monthly Payment Dec-18-09 $150,000 Final Architecture Specification Dec-30-2009
Requirements Document Review and Acceptance Acacia will review and accept the System Requirements Documents in a timely manner to ensure project delays are not incurred at each document update.					
1A	Architecture Specification Review and Acceptance	MS Word/ Adobe	MS Word	Architecture Specification	Within two calendar weeks of delivery
Design Specification ViaSat will deliver design specifications that details micro architecture design of each IP block. It contains block description, implementation details, interfaces, register map, control mechanism and any other details required.					
2V	Design Specification	MS Word/ Adobe	MS Word	Functional and Interface	3 Blocks Jan-15-2010 $600,000 All Blocks Mar-19-10
Design Specification Review and Acceptance Acacia will review and accept the Design Specifications documents in a timely manner to ensure project delays are not incurred at each document update.					

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 3 of 11

[Exhibit 22-496]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
This Accepted Design Specification Document will be what is to be coded in rtl and will become part of Exhibit C of the Agreement "Mutually Agreed Upon Specification for 100 Gbps Coherent DWDM Demodulator" (Final)					
3A	Design Specification Review and Acceptance.	MS Word/ Adobe	MS Word	Functional and Interface	Within two calendar weeks of the final block specification delivery $550,000
Verification Plan ViaSat will develop a Verification Plan for the IP and deliver to Acacia. The Verification Plan will describe in detail the organization of the testbench and the methodology that will be used for test of the IP. IP Cores that meet the mutually agreed upon Verification Plan will be deemed accepted.					
4V	Verification Plan	MS Word/ Adobe	MS Word	Verification	Feb-01-10
Verification Plan Review and Acceptance Acacia will review and accept the Verification Plan document to ensure project delays are not incurred.					Within two calendar weeks of delivery
5A	Verification Plan Review and Acceptance	MS Word/ Adobe	MS Word	Verification	
ASIC Vendor Tools Acacia will engage with their preferred ASIC Vendor and use commercially reasonable efforts to have them engage with ViaSat. ViaSat getting access to ASIC Libraries and tools specific to the vendor are critical for synthesis.					
6A	ASIC Vendor Tools for IP block synthesis			Acacia shall facilitate access to Libraries and Special Vendor Tools at no cost to ViaSat	Dec 7, 2009
RTL ViaSat shall create the synthesizable RTL Code for both IP blocks based on the agreed technical solution. The Architecture implemented will be based upon the mutually agreed upon Design Specification. RTL will be provided early with Verilog.					

[Exhibit 22-497]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
7V	DSP (IP) RTL Synthesis results, scripts, netlists, logfiles, etc. Verification results, tesbenches, tests, logfiles, etc.		(a) Synthesizable verilog – FPGA netlist (b) Synthesizable Verilog - Vendor Specific ASIC Netlist	All blocks to meet deliverable dates as shown to the right	Initial netlist drop – Reasonably developed RTL (block size within 20% of final area, RAMs and layout block I/O final) – Apr-22-10 Stable netlist drop (RTL 100% developed and functionality 80% verified. Blocks all defined no change in floor plan, DC timing 100% met) Jun-08-10 $550,000 Final netlist (all PD feedback incorporated, all bugs fixed, DC timing 100% met) drop. Sep-06-10 $600,000
RTL Reviews and Acceptance Acacia will review and Accept the RTL code developed in a timely manner to ensure					

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 5 of 11

[Exhibit 22-498]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
project delays are not incurred at each update.					
8A	IP RTL Review and Acceptance	MS Word/ Adobe	MS Word	Synthesis results, reports, testbenches and verification results	Within 45 business days of delivery

Testbench (supports both directed and random)

ViaSat will develop a testbench(es) for the IP Verilog/ System Verilog and deliver the testbench(es) to Acacia. The testbench will to enable Acacia to exercise and validate ViaSat RTL deliverables and enable module level testing.

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
9V	Testbenches and all related tools and scripts	VCS	Verilog/ System Verilog	Verification	Synchronized to RTL delivery (Initial, Stable and Final)

Testcases

(a) ViaSat will develop a suite of testcases that will execute on the testbench(s) for the IP block in Verilog/ System Verilog and deliver the testcases to Acacia. The testcases will enable Acacia to exercise and validate ViaSat RTL deliverables. ViaSat will provide an early list and description of the testcases and solicit Acacia input on the test suite.

(b) Test case document will be provided to Acacia that will describe details of each test executed on IP block

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
10V	Testcases	VCS	(a) Verilog/ System Verilog (b) MS Word	Verification	Synchronized to RTL delivery (Initial, Stable and Final)

Testcases Review and Acceptance

Acacia will review and Accept the Testcases in a timely manner to ensure project delays are not incurred at each update.

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
11A	Testcases Review				Tied to RTL acceptance

Synthesis (we will need fp netlist to vendor guidelines, acacia will provide scripts—goal is to deliver a netlist consistant with best practice and meets vendor guidelines)

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 6 of 11

[Exhibit 22-499]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
(a) ViaSat will synthesize the RTL and generate gate level netlists suitable for delivery to Acacia's chosen ASIC Vendor. (b) ViaSat will synthesize the RTL to develop gate level netlists suitable for delivery to Acacia's chosen FPGA.					
12V	Synthesis	(a) DC-Ultra (b) FPGA tools for (Altera Quartus/ Xilinx ISE)	(a) Verilog netlist (b) FPGA Specific results files.	* Partition to be defined early on the project to avoid any delays	Initial Netlist – Apr-22-10 Stable Netlist – Jun -08-10 Final Netlist - Sep-06-10
Synthesis Review and Acceptance Acacia will review and Accept the synthesis files (results, constraints, and scripts) in a timely manner to ensure project delays are not incurred at each update. Results will show evidence that RTL= Gates and that timing is met.					
13A	Synthesis Review & Acceptance				Within 45 business days after delivery
Foundry Completion of Backend Work Silicon foundry vendor to complete backend tasks including timing closure on the chip level and GDSII released for mask. ViaSat to provide support for minor bug fixes in support of timing closure of individual IP blocks that were delivered as part of the Agreement.					
14A	Foundry Backend Support				Tapeout
Validation of Prototype ASICs Acacia completes testing of first received ASICs. ViaSat to support Acacia with bug fixes and workarounds of final ASIC prototype for errors or bugs that can be traced back to ViaSat IP blocks. Acacia verification tests must be designed such that system performance and non-ViaSat IP within the ASIC can be separated from the performance of the Demodulator IP Cores where possible.					

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 7 of 11

[Exhibit 22-500]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
15A	Validation of Prototype ASICs		PDF		120 business days after silicon delivery $500,000 Milestone Payment shall be paid by Acacia the earlier of (a) 15 months from Final RTL Netlist Review and Acceptance or b) on Validation of Prototype ASICs.

Table 2. Deliverables and Responsibilities for Soft FEC IP core

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
Data sheet ViaSat will deliver a detailed data sheet that contains block description, interfaces, register map and any other details that is required.					
1V	Datasheet	MS Word/ Adobe	PDF	Functional and Interface	Jan-11-10
ASIC Vendor Tools (Acacia Deliverable to ViaSat) Acacia will engage with their preferred ASIC Vendor and use commercially reasonable efforts to have them engage with ViaSat. ViaSat getting access to ASIC Libraries and tools specific to the vendor are critical for synthesis.					

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
2A	ASIC Vendor Tools for Decoder synthesis			Acacia shall facilitate access to Libraries and Special Vendor Tools at no cost to ViaSat	Dec 7, 2009

IP Core

ViaSat will deliver IP core in netlist format consistent with Acacia's chosen ASIC vendor library.

ViaSat will also deliver encrypted RTL for simulation purpose (VCS or Modelsim)

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
3V	Encrypted Verilog and netlist	VCS	Verilog netlist		Initial Drop - Apr-22-10 Stable – Jun-08-10 Final – Sep-08-10

Testbench

ViaSat will deliver testbench(es) for the soft FEC core in System Verilog to Acacia. The testbench will to enable Acacia to exercise and validate soft decision FEC netlist.

Encrypted RTL for simulation purpose (VCS/Modelsim)

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
3V	Testbenches and all related tools and scripts	VCS	Verilog/ System Verilog	Verification	Synchronized with IP core

Testcases

(a) ViaSat will deliver suite of testcases that will execute on the testbench(s) for the FEC core in Verilog/ System Verilog and deliver the testcases to Acacia

(b) Test case document will be provided to Acacia that will describe details of each test executed on FEC core

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
4V	Testcases	VCS	(a) Verilog/ System Verilog (b) PDF	Verification	Synchronized to IP core delivery

Synthesis

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 9 of 11

[Exhibit 22-502]

Index & Owner	Deliverables	Tools Used	Delivery Format	Milestones	Delivery date
(a)	ViaSat will synthesize the RTL to develop gate level netlists suitable for delivery to Acacia's chosen ASIC Vendor.				
(b)	ViaSat will synthesize the RTL to develop gate level netlists suitable for delivery to Acacia's chosen FPGA.				
5V	Synthesis	(a) DC-Ultra (b) FPGA tools for (Altera Quartus/ Xilinx ISE)	(a) Verilog Netlist. (b) FPGA bitstream/netlist		Initial Netlist – Apr-22-10 Stable Netlist – Jun -08-10 Final Netlist - Sep-06-10

RTL code provided to Acacia will be translated by Acacia for implementation on a FPGA emulation board for system verification in a laboratory testbench. For the sake of clarity, deliverables are limited to RTL coding and ASIC support efforts and does not include the translation, partitioning, or synthesis of FPGA code for test on the FPGA emulation testbench hardware.

Any changes required to the RTL (except for changes related to any bugs traced back to ViaSat IP blocks discovered) after Final RTL Review and Acceptance are not covered under this Statement of Work. Any changes to RTL, subsequent deliverables, including, but not limited to, updated specifications, updated requirements, updated test benches, updated test cases, re-synthesis, and updated documentation are not covered under this Statement of Work unless they are related to bugs traced back to ViaSat IP blocks. Any design iterations will be covered under the Time and Material Development Agreement, Exhibit D of the IP Core Development and Licensing Agreement.

4   Change Management

Should changes to either the work product, the technical specifications, or scope of work be required after the Agreement is in place from either party, a written change request shall be documented in a suitable form and include the following information:

- Change description
- Perceived work product or specifications impact

After the impact is determined, said changes can be agreed to and the cost/schedule impact negotiated and approved in writing by the contract managers from ViaSat and Acacia, which approval will not be unreasonably delayed or withheld by either party.

Exhibit A to:

IP Core Development & License Agreement No. TG11102009

Page 11 of 11

[Exhibit 22-504]

Exhibit B - Specifications of Licensed Materials

This Specification of Licensed Materials is incorporated by reference under the IP Core Development and License Agreement No. TG11102009 dated as of November 20, 2009   by and between Acacia and ViaSat (the "Agreement"), along with the separate Exhibit A SOW. The term "License Materials" is defined in the Agreement.

1. Soft Decision FEC (SDFEC) Overview

As per Acacia's requirements for the Soft Decision Forward Error Correction (SDFEC) cores the following two cores will be developed by ViaSat:

- SDFEC Encoder core: This core will include the SDFEC Turbo Product Code (TPC) Encoder and will be targeted towards a 40 nm Fujitsu 40nm ASIC process technology or a mutually agreed upon FPGA.

- SDFEC Decoder core: This core will include the SDFEC TPC Decoder and will be targeted towards the Fujitsu 40 nm ASIC process technology. The SDFEC Decoder design will assume a 4-bit sign-magnitude soft-input.

ViaSat will work towards the proposed ~ 15% Overhead (OH) TPC. The key properties of this TPC are:

(a)   The code rate is ~0.87

(b)   Projected NECG of 11.1 dB at BER of 1e-15 in an (Additive White Gaussian Noise) AWGN channel.

Turbo Product Code (TPC) – Selected Code

After a detailed trade study, TPC codes were chosen which offer the best performance and have obvious complexity advantage in 100 Gbps implementation. TPC codes are suited for high speed implementations since they allow highly parallel decoding process. Based on Acacia's requirements a ~15 % OH TPC code was selected based on previous experience and simulation results:

Table 1 highlights the specifications for the SDFEC TPC chosen for the 100 Gbps application.

Parameter	Proposed TPC solution
Soft-Decision Resolution	4 bits soft input
NECG (QPSK on AWGN)	NECG is 11.1 dB @ 1E-15 BER. No flaring above BER=1e-15 proven by asymptotic analysis. Asymptotic performance below 1e-20 at Eb/N0 corresponding to

Exhibit B to:

IP Core Development & License Agreement No. TG11102009

Page 1 of 4

[Exhibit 22-505]

	1e-15 post FEC BER
Code Rate	0.87
Encoder/Decoder Throughput	~120 Gbps
Total Latency (encoder + decoder)	~10 us
Decoder Power Consumption	<8 W
Encoder Power Consumption	< 1 W
Burst Error Performance	>1200 bits

Table 1: SDFEC Specification Requirements check list for the proposed TPC

2.   SDFEC Encoder Core

(a)   Functionality

The proposed SDEFEC TPC Encoder core will contain input and output buffering, parity removal (the parity bits from G.709 FEC) and a highly parallel TPC encoding circuitry followed by interleaving. This core will be a customized derivative of ViaSat's generic TPC Encoder core which can support a multitude of different TPC configurations (different blocksizes and code-rates). This core was especially designed for communication links that require high data rates, low latency, high spectral efficiency, and a high degree of forward error correction capability. The core allows a suitable data and monitoring interface options as shown in Figure 1. Additionally, the SDFEC Encoder Core may add the appropriate training sequences to the signal if required by the demodulator.

[Exhibit 22-506]

(b)   **Block Diagram**

Figure 1. Top level block diagram of the TPC Encoder core

3.   SDFEC Decoder Core

(a)   Functionality

The proposed SDEFEC TPC Decoder core will contain input and output buffering, deinterleaving, and a highly parallel TPC decoding circuitry. This core will be a customized derivative of ViaSat's generic TPC Decoder core which can support a multitude of different TPC configurations (different blocksizes and code-rates). This core was especially designed for communication links that require high data rates, low latency, high spectral efficiency, and a high degree of forward error correction capability. The core allows a suitable data and monitoring interface options as shown in Figure 2.

[Exhibit 22-507]
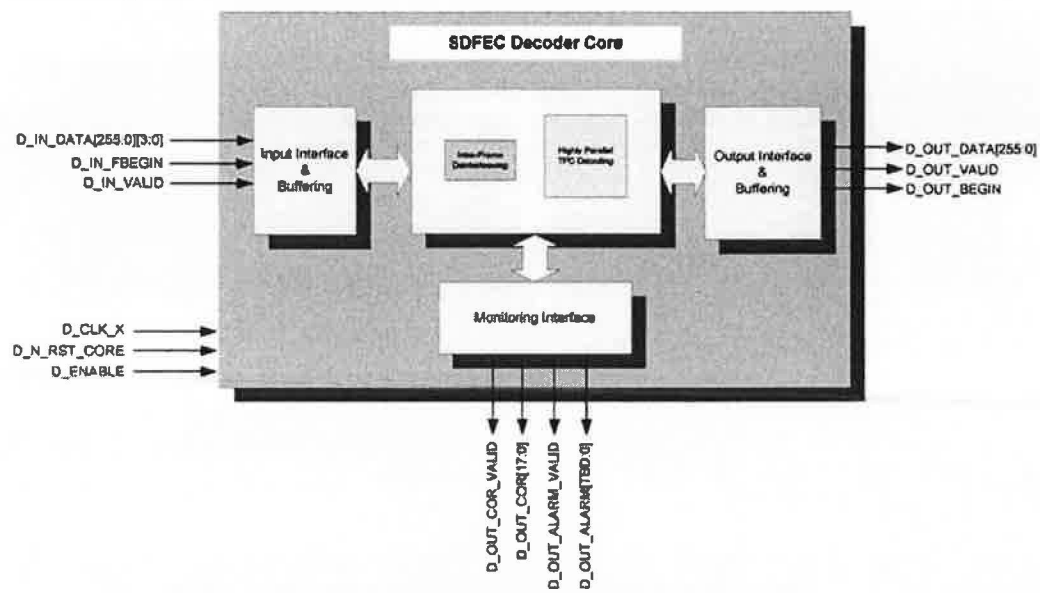
(b)   **Block Diagram**

Figure 2. Top level block diagram of the TPC Decoder core

[Exhibit 22-508]

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Mutually Agreed Upon Specification for 100 Gbps Coherent DWDM Demodulator

Contract No.: *TG11102009*
Document No.: xxxxxxx, Rev. 002

11/10/2009

Prepared for:

Acacia Communications Inc.
Boston MA

Prepared by:

ViaSat

ViaSat Inc.
4830 East 49th Street
Cuyahoga Heights, Ohio 44125

[Exhibit 22-509]

Document No. xxxxxxx Rev. 002
11/10/09

Revision Record

Revision	Rationale	Release Date
Rev 001	Initial Release	10/23/2009
Rev 002	Updated per results of technical meetings during weed of 11/2/09	11/10/2009

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page i of 15

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Proprietary and Confidential

[Exhibit 22-510]

Table of Contents

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page ii of 15

Proprietary and Confidential

[Exhibit 22-511]

List of Figures

List of Tables

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page iii of 15

[Exhibit 22-512]

1   SCOPE

This document captures the Functional Specifications for the Encoder, Demodulator / DSP, FEC Decoder and Framer cores being developed by ViaSat – ECC for Acacia Communications Inc. (hereby referred to as Acacia). The following paragraphs identify the applicability of this document and summarize the type of information contained as well as the overall structure of this Functional Specifications.

1.1   Identification

This document is applicable to all the Firmware (FW), Software (SW) and system engineering / research activities being performed by ViaSat – ECC for the Encoder, Demodulator, FEC Decoder and Framer cores.

1.2   System Overview

Acacia is designing coherent dense wavelength division multiplexed (DWDM) transponder modules for 100G optical transport. The DWDM transponder is the key piece in optical transport systems as it provides transmit and receive interfaces to the long haul optical link and therefore determines the overall system capabilities and performance.

Acacia's transponder will include a coherent receiver ASIC that houses the high-speed ADCs as well as Demodulator, FEC Decoder and Hard Decision (HD) FEC Reframer cores being developed by ViaSat – ECC. Figure 1 shows a top-level block diagram of the ASIC with the Demodulator, Decoder and Framer cores highlighted / shaded in orange.

The Demodulator in the coherent DWDM module processes the samples of the analog in-phase and quadrature components of the two polarization components to recover the transmitted data with minimum bit error rate (BER). The processing includes equalization of link distortions and compensation of various imperfections in the transmitter and receiver. The demodulator also detects and synchronizes to the FEC frame boundaries to provide complete FEC frames to the decoder.

The FEC Decoder is responsible for using the redundancy / parity bits / overhead embedded in the signal on the Transmit side to recursively process the Demodulated data and correct the remaining data errors to lead to the desired BER performance levels.

The HD-FEC Reframer is responsible for taking the decoded data from the FEC Decoder and repackaging it to look like a standard 7 % OH OTN frame going out of the receiver ASIC.

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 1 of 15

Proprietary and Confidential

[Exhibit 22-513]
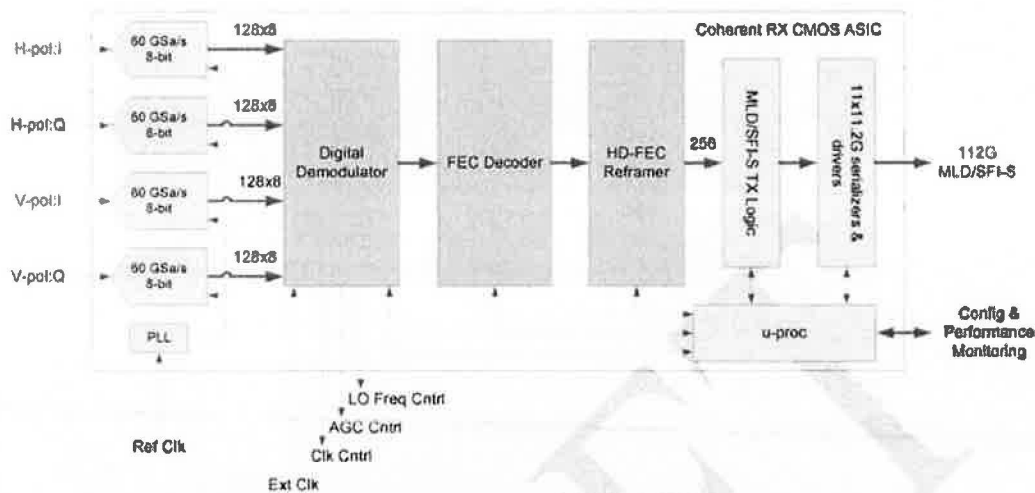
Figure 1: Coherent RX CMOS ASIC Top

ViaSat – ECC will provide the corresponding FEC Encoder (see Exhibit B – Specification of Licensed Material) and HD-FEC Deframer module for the transmit path as shown in Figure 2. The transmit path processing may be targeted to a Field Programmable Gate Array (FPGA) or possibly the ASIC if the gate count is acceptable.
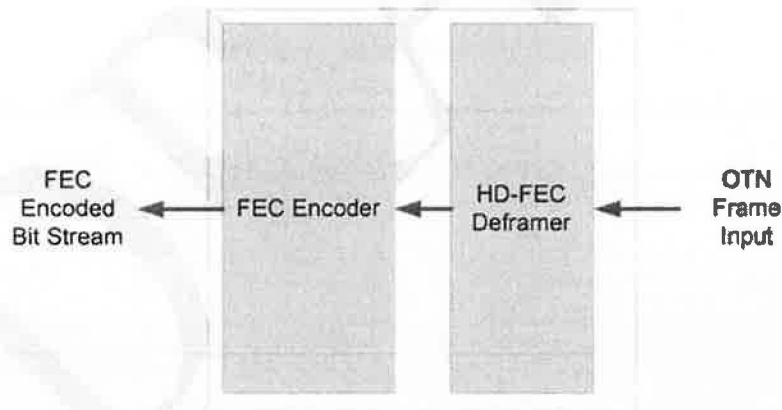

Figure 2: Transmit Path Modules

The HD-FEC Deframer is responsible for taking in a standard 7 % overhead OTN frame, stripping off the parity bits, and repackaging the frame for the FEC Encoder.

The FEC Encoder is responsible for generating and inserting the redundancy / parity bits / overhead required for full frame recovery and FEC decoding at the receiver. (See Exhibit B – Specification of Licensed Material)

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 2 of 15

[Exhibit 22-514]

Document No. xxxxxxx Rev. 002
11/10/09

1.3   Document Overview

This document defines the HD-FEC Deframer, Demodulator, and HD-FEC Reframer core functional specifications.

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 3 of 15

[Exhibit 22-515]

Document No. xxxxxxx Rev. 002
11/10/09

2   REFERENCED DOCUMENTS

This section shall list the number, title, revision, and date of all documents referenced in this document.

[1] Digital Signal Processing for 100G coherent DWDM transponder modules, Christian Rasmussen, Rev 1.2, September 9, 2009

[2] 100 G Soft-Decision FEC Selection Analysis, ViaSat – ECC, June 12, 2009

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 4 of 15

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[Exhibit 22-516]

3   FUNCTIONAL SPECIFICATION

This section shall be divided into the following paragraphs to define the functional specifications of the design modules.

3.1   HD-FEC Deframer

This module takes in standard 7% overhead OTN frames and, strips off the parity bits and formats the data for the FEC Encoder. Details TBD.

3.2   FEC Encoder

See Exhibit B – Specification of Licensed Material

3.3   Demodulator

The Demodulator in the coherent DWDM module processes the samples of the analog in-phase and quadrature components of the two polarization components to recover the transmitted data with TBD bit error rate (BER). The top level demodulator design is show in Figure 3.
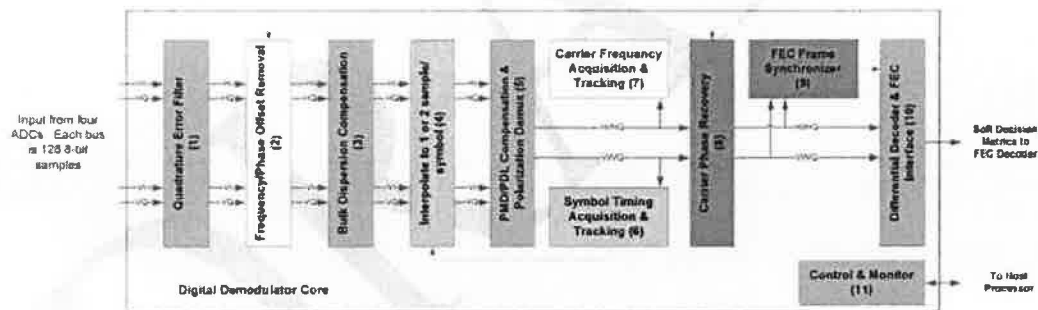
Figure 3: Demodulator Top Level Block Diagram

The demodulator accepts 128 8-bit data samples from each of the four ADCs each rising edge of the ADC clock (nominally 437.5 MHz). The format of the ADC samples is TBD.

The demodulator provides demodulated, TBD-bit, soft decision metrics out to the FEC decoder. A TBD handshake mechanism is implemented to indicate the boundary between FEC frames.

The demodulator may or may not provide outputs for LO frequency control, ADC clock control, and analog gain control. The system impacts of these external control mechanisms must be understood and defined to complete the demodulator design effort.

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 5 of 15

[Exhibit 22-517]

The demodulator has a control and monitor interface to the host processor allowing configuration of various demodulator parameters (filter coefficients, loop gains, etc.) and extraction of demodulator status.

The following sections detail the functional specification for the major sub-modules within the demodulator design.

3.3.1 Quadrature Error Filters

Something similar to our quadrature error filter module. Remove DC bias, gain mismatch and I/Q phase imbalance.

I/Q sample times may be skewed and we need a way to detect the skew and correct for it. Correction could be done via NCO skews in the Farrow but how do we measure it?

May also need to re-time the samples from multiple channels.

3.3.2 Frequency/Phase Offset Removal

The frequency/phase offset removal consists of two banks of 128 vector rotation functions as shown in Figure 4. The vector rotation may be via CORDIC functions with associated NCO or via a true complex multiply with associated sin/cos LUT and NCO.
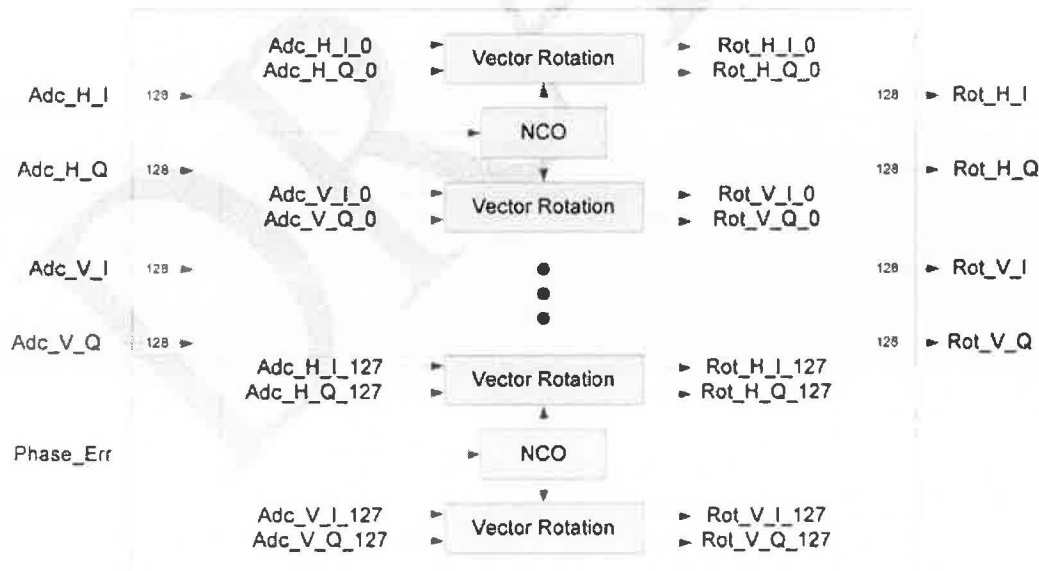

Figure 4: Frequency/Phase Offset Removal Top Level

[Exhibit 22-518]

Decision here will be based on design complexity. CORDICs would be pipelined to allow for a new I/Q pair per clock.

3.3.3   Bulk Dispersion Compensation

This block will consist of a pair of FFTs, implementation of a phase correction filter in the frequency domain (complex multiplies or CORDIC phase shift?) followed by a pair of IFFTs to reconstruct the data as shown in Figure 5.
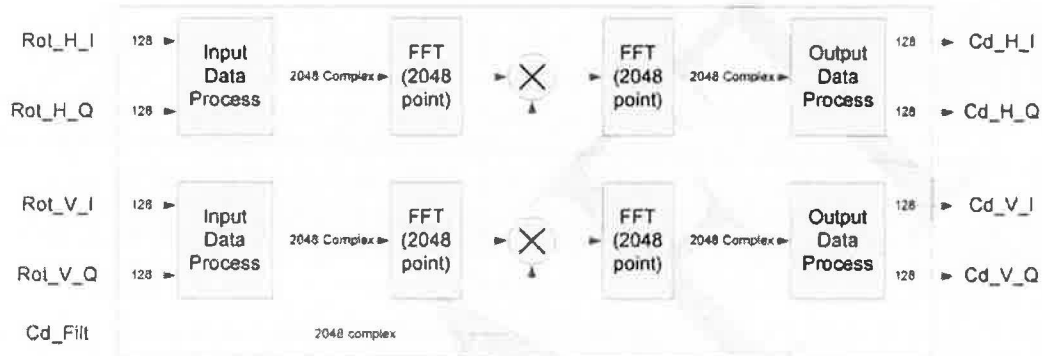

Figure 5: Bulk Dispersion Compensation Top Level

Phase correction filter taps are configurable via the control and monitor port to allow the host processor to implement an adaptive tap update algorithm and feedback the updated tap values. Some form of error metric will be available to the processor for updating taps.
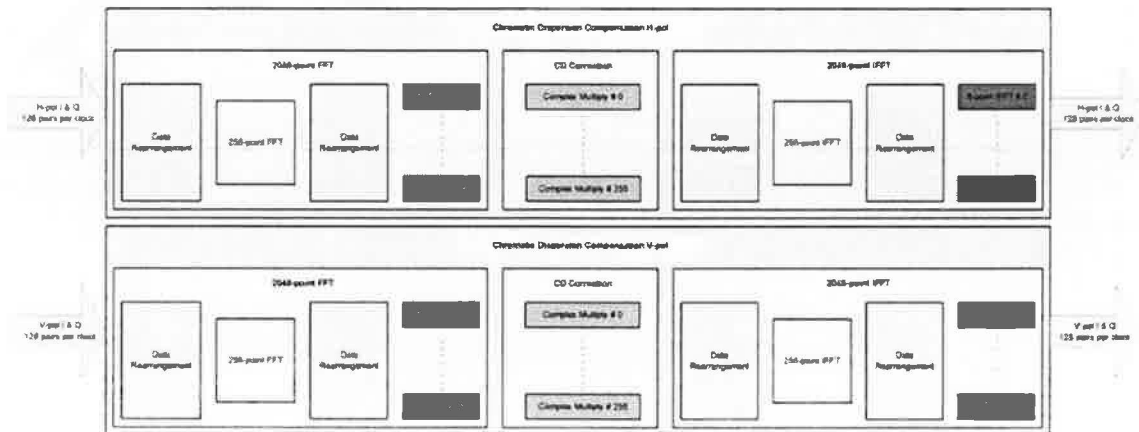
FFTs use an overlapped window.

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 7 of 15

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[Exhibit 22-519]

3.3.4   Sample-to-Symbol Interpolation

The 100G Sample-to-Symbol Interpolator takes in samples at 63 Gsps and outputs symbols at 30 Gsps for a decimation ratio of 2.100.

3.3.5   PMD/PDL Compensation and Polarization Demux

Multiple (4? – HI/VI, HI/VQ, HQ/VI, HQ/VQ) banks adaptive FIR filters operating at 1 sample/symbol. Each bank would implement 64 FIR filters with tap values valid for all filters within the bank.

Tap update algorithm has two modes. At start-up, a CMA algorithm is used to converge on a solution. Once in a steady-state mode, a decision directed algorithm is used to track changes. The tap updates are done in hardware with a TBD tap update rate.

3.3.6   Symbol Timing Acquisition and Tracking

An early/late symbol timing method is used to track symbol timing errors. The error is filtered via a PI controller and the filtered error is output to the sample-to-symbol interpolation block.

Assuming the two polarizations are symbol synchronous (are they?), one instance of the algorithm can provide symbol timing control for both.

3.3.7   Carrier Frequency Acquisition and Tracking

Residual carrier frequency error is measured here via a TBD algorithm. The error is filtered via a PI controller and the filtered error is output to provide frequency control for the tunable laser.

Update rate and method of delivery to the laser are TBD.

3.3.8   Carrier Phase Recovery

Carrier phase recovery via a TBD algorithm. The error is filtered via a PI controller and the filtered error is output to the frequency/phase offset removal block.

Two possible modes, differential mode (safe) or non-differential mode (better solution but riskier due to insufficient models). Do we start implementing the safe mode? Do we want to implement both modes?

Algorithm monitors known symbols in the waveform (headers/pilots) to resolve 90° phase ambiguity.

[Exhibit 22-520]

3.3.9 FEC Frame Synchronizer

Soft correlation algorithm with synchronization state machine searches for and synchronizes to FEC frame header. Unique header values used to identify the two polarizations.

Frame synchronizer marks boundaries of each FEC frame and passes demodulated FEC frames to the FEC decoder.

3.3.10 Differential Decoder & FEC Interface

TBD. Outside Scope of Original Work/ROM Estimate.

3.3.11 Control and Monitor

Host processor interface provides access to demodulator configuration and status registers.

3.4 FEC Decoder

See Exhibit B – Specification of Licensed Material

3.5 HD-FEC Reframer

The HD-FEC reframer is responsible for taking in the TPC decoded data and sending out standard OTN Frames to make the Transponder with the enhanced FEC almost transparent to the end equipment.

The Framer will perform standard 7% OH RS code encoding on the TPC Decoded data (info bits only) and arrange the parity bits as per the OTN Frame structure.

Table 1: Specifications of the Framer

Parameter	Specifications
FEC Type	RS
Code Rate	0.93
Overhead	~7 %
Incoming Line Rate	~ 103 Gbps (TPC Decoded (info bits only))
Outgoing Line Rate	~112 Gbps

Exhibit C to:

IP Core Development & License Agreement No. TG11102009

Page 9 of 15

[Exhibit 22-521]

Latency	< 3 us
Power Consumption	< 1 W
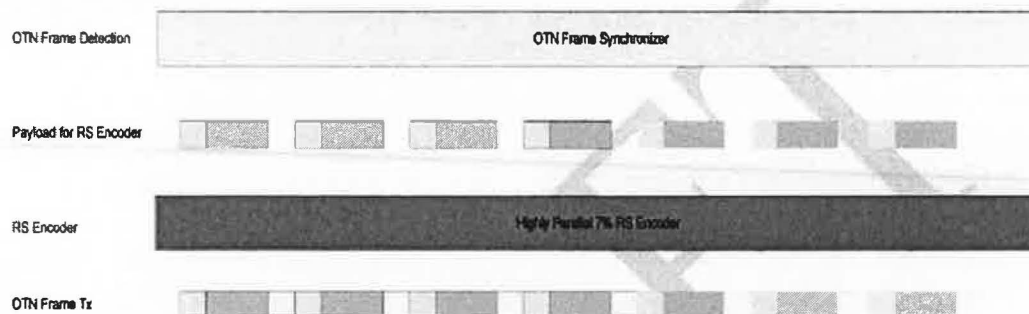
Figure 6. Data processing performed by the HD-FEC Reframer

[Exhibit 22-522]

4   NOTES

This section shall contain any general information that aids in understanding this document (e.g., background information, glossary, rationale). This section shall include an alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document and a list of any terms and definitions needed to understand this document.

4.1   Acronyms

Table 2. Acronyms.

Acronym/Abbreviation	Definition
ASIC	Application Specific Integrated Circuit
BCH	Bose, Chaudhuri and Hocqunghem
BER	Bit Error Rate
CD	Chromatic Dispersion
DWDM	Dense Wavelength Division Multiplexing
ENOB	Effective Number Of Bits
FEC	Forward Error Correction
FPGA	Field Programmable Gate Array
HD-FEC	Hard Decision FEC
HIHO	Hard-Input Hard-Output
PMD	Polarization Mode Dispersion
QPSK	Quadrature Phase Shift Keying
RS	Reed Solomon
SFDR	Spur Free Dynamic Range
SISO	Soft-Input Soft-Output
TPC	Turbo Product Code

[Exhibit 22-523]

EXHIBIT D - TIME AND MATERIALS SUPPORT

The following Time and Materials support provisions shall apply to out-of-scope design iteration work cited in Section 2.b of IP Core Development and License Agreement No. TG11102009:

1) **Project Assignment:** ViaSat and Acacia shall agree in writing on a reasonable budget allocation for each out-of-scope design iteration ("Project Assignment") to be performed by ViaSat hereunder. ViaSat shall have no obligation to perform any out-of-scope design iteration unless and until a Project Assignment describing the Services has been signed by both ViaSat and Acacia. ViaSat will honor any limitations on labor, cost or time set forth in each applicable Project Assignment, but completion of all work within such limitations is not guaranteed. Any estimates of labor, cost or time furnished to Acacia by ViaSat before or after execution of any Project Assignment shall be considered estimates only, and shall not obligate ViaSat to complete any Services(s) within the parameters estimated.

2) **Acacia's Commitment of Resources:** Acacia shall provide ViaSat with access to such Acacia's materials, information, facilities and employees reasonably required to complete the Project Assignment. Acacia acknowledges that ViaSat's ability to perform the out-of-scope design iteration work as contemplated in any Project Assignment will depend upon the proper fulfillment by Acacia and any third party vendor of Acacia of Acacia's obligations under the Project Assignment.

3) **Fees, Expenses and Payments:** Acacia shall pay the fees and expenses for materials set forth in each Project Assignment or other Exhibit attached hereto and for the time incurred by ViaSat in the performance of its obligations under the Project Assignment. Except as otherwise specified in the applicable Project Assignment, Acacia shall also pay ViaSat for reasonable expenses associated with travel, lodging, and meals in connection with the performance of the Services under this Agreement. ViaSat shall charge at a rate of $190 per hour for all labor assigned to the completion of any out-of-scope design iteration work. ViaSat will invoice Acacia monthly for out-of-scope design iteration work performed and any expenses incurred by ViaSat under a Project Assignment during the preceding month. Payment terms will be the same as those governing the IP Core Development and Licensing Agreement.

Exhibit D to:

IP Core Development & License Agreement No. TG11102009

Page 1 of 1

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[Exhibit 22-524]